

CLAIMS

What is claimed is:

1. A method implemented on a network device for use in a storage area network, the method comprising:
 - receiving or generating a packet or frame compatible with a standard protocol employed in the storage area network;
 - encapsulating the packet or frame with a virtual storage area network identifier and information specifying at least one of a TTL value and MPLS information; and
 - sending the encapsulated packet or frame.
2. The method of claim 1, wherein the network device is a switch and wherein sending the encapsulated packet or frame comprises sending the encapsulated packet or frame over an inter-switch link in the storage area network.
3. The method of claim 1, wherein encapsulating comprises appending a header to the packet or frame to create a new packet or frame, wherein the header includes fields for the virtual storage area network identifier and information specifying at least one of the TTL value and the MPLS information.
4. The method as recited in claim 1, wherein the TTL value specifies a number of remaining hops that can be traversed before the encapsulated packet or frame is dropped.
5. The method as recited in claim 1, wherein the TTL value specifies a remaining lifetime.
6. The method of claim 3, further comprising calculating an error check value for the new packet or frame and including the error check value in the new packet or frame.
7. The method of claim 3, wherein the header includes a first field for the TTL value and a second field for the MPLS information.
8. The method of claim 3, wherein the header further comprises a field specifying a type of traffic to be carried by the packet or frame, and wherein the available types include at least one of Ethernet, fibre channel, and Infiniband.

9. The method of claim 8, wherein the type of traffic to be carried by the packet or frame specifies the standard protocol of the packet or frame.
10. The method of claim 8, wherein the header includes four bits for the field specifying a type of traffic to be carried by the packet or frame.
11. The method of claim 3, wherein the header further comprises a field specifying a user priority for the packet or frame.
12. The method of claim 1, wherein the standard protocol is Fibre Channel.
13. The method of claim 1, wherein the standard protocol is Ethernet.
14. The method of claim 1, wherein the standard protocol is Infiniband.
15. The method of claim 3, wherein the header field for the virtual storage area network identifier has 12 bits reserved.
16. The method of claim 3, wherein the header includes a TTL field and the field has 8 bits reserved.
17. The method of claim 3, wherein the header includes an indicator field to indicate whether one or more MPLS labels are present.
18. The method of claim 3, wherein the header includes an indicator field to indicate a number of MPLS labels present in the new packet or frame.
19. The method of claim 3, wherein the new packet or frame includes one or more MPLS labels, each of the labels including an indicator to indicate whether the label is the last label in a label stack.
20. The method of claim 17, wherein the indicator field one bit.
21. The method of claim 1, wherein the header further includes a version field indicating a version of the header.
22. A computer-readable medium storing thereon computer-readable instructions for performing a method on a network device in a storage area network, comprising:
 - instructions for receiving or generating a packet or frame compatible with a standard protocol employed in the storage area network;
 - instructions for encapsulating the packet or frame with a virtual storage area network identifier and information specifying at least one of a TTL value and MPLS information; and
 - instructions for sending the encapsulated packet or frame.

23. The computer-readable medium of claim 22, wherein the network device is a switch and wherein the instructions for sending the encapsulated packet or frame comprise instructions for sending the encapsulated packet or frame over an inter-switch link in the storage area network.
24. The computer-readable medium of claim 22, wherein the instructions for encapsulating comprise instructions for appending a header to the packet or frame to create a new packet or frame, wherein the header includes fields for the virtual storage area network identifier and information specifying at least one of the TTL value and the MPLS information.
25. The computer-readable medium as recited in claim 22, wherein the TTL value specifies a number of remaining hops that can be traversed before the encapsulated packet or frame is dropped.
26. The method as recited in claim 22, wherein the TTL value specifies a remaining lifetime.
27. The computer-readable medium of claim 24, further comprising instructions for calculating an error check value for the new packet or frame and including the error check value in the new packet or frame.
28. The computer-readable medium of claim 24, wherein the header includes a first field for the TTL value and a second field for the MPLS information.
29. The computer-readable medium of claim 24, wherein the header further comprises a field specifying a type of traffic to be carried by the packet or frame, and wherein the available types include at least one of Ethernet, fibre channel, and Infiniband.
30. The computer-readable medium of claim 29, wherein the type of traffic to be carried by the packet or frame specifies the standard protocol of the packet or frame.
31. The computer-readable medium of claim 29, wherein the header includes four bits for the field specifying a type of traffic to be carried by the packet or frame.
32. The computer-readable medium of claim 24, wherein the header further comprises a field specifying a user priority for the packet or frame.
33. The computer-readable medium of claim 22, wherein the standard protocol is Fibre Channel.

34. The computer-readable medium of claim 22, wherein the standard protocol is Ethernet.
35. The computer-readable medium of claim 22, wherein the standard protocol is Infiniband.
36. The computer-readable medium of claim 24, wherein the header field for the virtual storage area network identifier has 12 bits reserved.
37. The computer-readable medium of claim 24, wherein the header includes a TTL field and the field has 8 bits reserved.
38. The computer-readable medium of claim 24, wherein the header includes an indicator field to indicate whether one or more MPLS labels are present.
39. The computer-readable medium of claim 24, wherein the new packet or frame includes one or more MPLS labels, each of the labels including an indicator to indicate whether the label is the last label in a label stack.
40. The method of claim 24, wherein the header includes an indicator field to indicate a number of MPLS labels present in the new packet or frame.
41. The computer-readable medium of claim 38, wherein the indicator field is one bit.
42. The computer-readable medium of claim 22, wherein the header further includes an indicator field to indicate whether the header is present.
43. The computer-readable medium of claim 22, wherein the header further includes a version field indicating a version of the header.
44. A network device for use in a storage area network, the network device comprising:
a plurality of ports each configured to transmit and/or receive packets or frames compatible with one or more standard protocols employed in the storage area network; and
a processor and associated instructions that can encapsulate packets or frames of at least one of the standard protocols to include a virtual storage area network identifier and information specifying at least one of a TTL value and MPLS information and deliver the resulting encapsulated packets or frames for transmission over the storage area network.
45. A network device for use in a storage area network, the network device comprising:
means for transmitting and/or receive packets or frames compatible with one

or more standard protocols employed in the storage area network; and
means for encapsulating packets or frames of at least one of the standard protocols to include a virtual storage area network identifier and information specifying at least one of a TTL value and MPLS information; and
means for delivering the resulting encapsulated packet or frames for transmission over the storage area network.

46. A switch for use in a storage area network, the switch comprising:
a plurality of ports each configured to transmit and/or receive packets or frames compatible with one or more standard protocols employed in the storage area network, where at least one of the ports supports an inter-switch link with another switch on a storage area network; and
a processor and associated instructions that can encapsulate packets or frames of at least one of the standard protocols to include a virtual storage area network identifier and information specifying at least one of a TTL value and MPLS information and deliver the resulting encapsulated packets or frames for transmission from the port supporting the inter-switch link.

47. The switch of claim 46, wherein the port supporting an inter-switch link provides fibre channel packets or frames.

48. The switch of claim 46, wherein the port supporting an inter-switch link provides Ethernet packets or frames.

49. The switch of claim 46, wherein the port supporting an inter-switch link provides Infiniband packets or frames.

50. The switch of claim 46, further comprising a plurality of line cards, each providing at least one of the plurality of ports.

51. The switch of claim 46, wherein the processor can encapsulate said packets or frames by adding a header to the packets or frames to create new packets or frames, wherein the header includes fields for the virtual storage area network identifier and information specifying at least one of the TTL value and the MPLS information.

52. The switch of claim 51, wherein the processor can calculate an error check value for the new packet or frame and include the error check value in the new packet or frame.

53. The switch of claim 51, wherein the header includes a first field for the TTL value and a second field for the MPLS information.

54. The switch of claim 51, wherein the header further comprises a field specifying a type of traffic to be carried by the packet or frame, and wherein the

available types include at least one of Ethernet, fibre channel, and Infiniband.

55. A method implemented on a network device for use in a storage area network, the method comprising:

- receiving or generating a packet or frame compatible with a standard protocol employed in the storage area network;
- encapsulating the packet or frame with a virtual storage area network identifier and information specifying a type of traffic to be carried by the packet or frame, wherein the available types include at least one of Ethernet, fibre channel, and Infiniband; and
- sending the encapsulated packet or frame.

56. The method of claim 55, wherein the network device is a switch and wherein sending the encapsulated packet or frame comprises sending the encapsulated packet or frame over an inter-switch link in the storage area network.

57. The method of claim 55, wherein encapsulating comprises adding a header to the packet or frame to create a new packet or frame, wherein the header includes fields for the virtual storage area network identifier and the type of traffic to be carried by the packet or frame.

58. The method of claim 57, wherein the header further includes a first field for the TTL value and a second field for the MPLS information.

59. The method of claim 55, wherein the type of traffic to be carried by the packet or frame specifies the standard protocol of the packet or frame.

60. A computer-readable medium storing thereon computer-readable instructions for performing a method on a network device in a storage area network, comprising:

- instructions for receiving or generating a packet or frame compatible with a standard protocol employed in the storage area network;
- instructions for encapsulating the packet or frame with a virtual storage area network identifier and information specifying a type of traffic to be carried by the packet or frame, wherein the available types include at least one of Ethernet, fibre channel, and Infiniband; and
- instructions for sending the encapsulated packet or frame.

61. The computer-readable medium of claim 60, wherein the network device is a switch and wherein sending the encapsulated packet or frame comprises sending the encapsulated packet or frame over an inter-switch link in the storage area network.

62. The computer-readable medium of claim 60, wherein the instructions for encapsulating comprise instructions for adding a header to the packet or frame to create a new packet or frame, wherein the header includes fields for the virtual storage area network identifier and the type of traffic to be carried by the packet or frame.

63. The computer-readable medium of claim 62, wherein the header further includes a first field for the TTL value and a second field for the MPLS information.

64. The computer-readable medium of claim 60, wherein the type of traffic to be carried by the packet or frame specifies the standard protocol of the packet or frame.

65. A method implemented on a switch for use in a fibre channel network, the method comprising:
receiving or generating a fibre channel packet or frame;
encapsulating said fibre channel packet or frame with a TTL value; and
sending the encapsulated packet or frame over an inter-switch link in the fibre channel network.

66. A computer-readable medium storing thereon computer-readable instructions for performing a method on a switch for use in a fibre channel network, comprising:
instructions for receiving or generating a fibre channel packet or frame;
instructions for encapsulating said fibre channel packet or frame with a TTL value; and
instructions for sending the encapsulated packet or frame over an inter-switch link in the fibre channel network.